

Claims

1. A filter (23, 24) for a cartridge (9) containing a particulate material (20), wherein the filter is intended to permit passage of a liquid through the filter and thus the cartridge, but to prevent passage of the particulate material, wherein the filter permits the liquid to pass through the filter in a filter direction (x), characterised in that the filter includes at least one slit-shaped opening (30), which has a first extension (31) and a second extension (32) being substantially perpendicular to the filter direction (x) and to the first extension (31), wherein the second extension is significantly shorter than the first extension.
2. A filter according to claim 1, characterised in that the second extension (32) is significantly shorter than the length (33) of the slit-shaped opening in the filter direction (x).
3. A filter according to any one of claims 1 and 2, characterised in that the second extension (32) is equal to or less than 0,12 mm.
4. A filter according to any one of claims 1 and 2, characterised in that the second extension (32) is equal to or less than 0,10 mm or 0,08 mm.
5. A filter according to any one of the preceding claims, characterised in that the second extension (32) is equal to or more than 0,02 mm.
6. A filter according to any one of the preceding claims, characterised in that the second extension (32) is equal to or more than 0,04 mm.
7. A filter according to any one of the preceding claims, characterised in that the second extension (32) is approximately 0,06 mm.

8. A filter according to any one of the preceding claims, characterised in that the filter (23, 24) is made of a polymer material, including one of polypropylene and polycarbonate.
- 5 9. A filter according to any one of the preceding claims, characterised in that the first extension (31) is substantially perpendicular to the filter direction (x).
- 10 10. A filter according to any one of the preceding claims, characterised in that the filter (23, 24) includes a filter element (29, 29'), wherein the slit-shaped opening (30) extends through the filter element (29, 29').
- 15 11. A filter according to claim 10, characterised in that the filter (23, 24) includes a plurality of slit-shaped openings (30), which extend through the filter element (29, 29').
- 20 12. A filter according to claim 11, characterised in that the first extension of each slit-shaped opening (30) extends in a radial direction towards a centre point of the filter element (29, 29').
- 25 13. A filter according to any one of claims 10 to 12, characterised in that the filter element (29) has a shape of a substantially plane disc.
- 30 14. A filter according to any one of claims 10 to 12, characterised in that the filter element (29') has a conical shape.
- 35 15. A filter according to claim 14, characterised in that the filter (24) includes a peripheral support portion connected to the filter element (29') and adapted to abut an inner wall of the cartridge (9).
16. A filter according to claim 15, characterised in that the peripheral support portion has a peripheral surface and includes a plurality of ridges projecting from the peripheral surface and adapted to abut the inner wall of the cartridge so that a thin gap is

formed between the peripheral surface and the inner wall, said gap providing a further passage for the liquid.

5 17. A filter according to any one of claims 10 to 16, characterised in that the slit-shaped opening (30) of the filter element (29, 29') has a first end and a second end, wherein the second extension (32) of the slit-shaped opening (32) increases from a minimum value at the one of the ends of the slit-shaped opening to a maximum value at the other end of the opening.

10 18. A filter according to any one of claims 1 to 9, characterised in that the filter (23, 24) includes a filter element formed by a first disc (41) and a second disc (42), which are arranged substantially in parallel with each other and separated from each other by an interspace (44) that form the slit-shaped opening (30).
15

19. A filter according to claim 18, characterised in that the interspace (44) is formed by distance members (43) arranged in the interspace (44) between the discs (41, 42), each of said distance
20 members (43) having a predetermined height corresponding to the second extension (32).

20. A filter according to 19, characterised in that each of said distance members (43) includes a projection extending from one of
25 the first disc (41) and the second disc (42).

21. A filter according to any one of claims 18 to 20, characterised in that the first disc (41) is provided with at least one aperture (46) forming an outlet passage to the interspace, and that the second
30 disc (42) is provided with at least one aperture (47) forming an inlet passage from the interspace.

22. A filter according to any one of the preceding claims, characterised in that the filter (23, 24) is made through an injection
35 moulding process.

23. A cartridge arranged to contain a particulate material (20), wherein the cartridge includes:
an inner space (10) for housing the particulate material;
an inlet (21) arranged to permit the introduction of a liquid into the
5 inner space (10);
an outlet (22) arranged to permit the discharge of liquid from the inner space (10); and
at least a first filter (23) arranged at the outlet (22) and to permit passage of the liquid through the filter, but to prevent passage of
10 the particulate material (20) through the filter, wherein the filter permits the liquid to pass through the filter in a filter direction (x), characterised in that the filter (23) includes at least one slit-shaped opening (30), which has a first extension (31) and a second extension (32) being substantially perpendicular to the filter
15 direction (x) and to the first extension, wherein the second extension (32) is significantly shorter than the first extension (31).

24. A cartridge according to claim 23, wherein the cartridge includes a second filter (24) arranged at the inlet (21) and to permit
20 passage of the liquid through the filter (24), but to prevent passage of the particulate material (20) through the filter (24), wherein the second filter permits the liquid to pass through the filter (24) in a filter direction (x), characterised in that the second filter includes at least one slit-shaped opening, which has a first extension (31) and
25 a second extension (32) being substantially perpendicular to the filter direction (x) and to the first extension (31), wherein the second extension (32) is significantly shorter than the first extension (31).

25. A cartridge according to any one of claims 23 and 24,
30 characterised in that the second extension (32) is significantly shorter than the length of the slit-shaped opening in the filter direction (x).

26. A cartridge according to any one of claims 23 to 25,
35 characterised in that the second extension (32) is equal to or less than 0,12 mm.

27. A cartridge according to any one of claims 23 to 26, characterised in that the second extension (32) is equal to or less than 0,10 mm or 0,08 mm.
- 5 28. A cartridge according to any one of claims 23 to 27, characterised in that the second extension (32) is equal to or more than 0,02 mm.
- 10 29. A cartridge according to any one of claims 23 to 28, characterised in that the second extension (32) is equal to or more than 0,04 mm.
- 15 30. A cartridge according to any one of claims 23 to 29, characterised in that the second extension (32) is approximately 0,06 mm.
- 20 31. A cartridge according to any one of claims 23 to 30, characterised in that the filter (23, 24) is made of a polymer material, including one of polypropylene and polycarbonate.
- 25 32. A cartridge according to any one of claims 23 to 31, characterised in that the first extension (31) is substantially perpendicular to the filter direction (x).
- 30 33. A cartridge according to any one of claims 23 to 32, characterised in that the filter (23, 24) includes a filter element (29, 29'), wherein the slit-shaped opening (30) extends through the filter element.
- 35 34. A cartridge according to claim 33, characterised in that the filter (23, 24) includes a plurality of slit-shaped openings (30), which extend through the filter element (29, 29').
- 35 35. A cartridge according to claim 34, characterised in that the first extension (31) of each slit-shaped opening (30) extends in a radial direction towards a centre point of the filter element (29, 29').

36. A cartridge according to any one of claims 33 to 35, characterised in that the filter element (29) has a shape of a substantially plane disc.

5 37. A cartridge according to claim 24 and 33, characterised in that the filter element (29') of the second filter (24) has a conical shape.

10 38. A cartridge according to any one of claims 33 to 37, characterised in that the slit-shaped opening (30) of the filter element (29, 29') has a first end and a second end, wherein the second extension (32) of the slit-shaped opening increases from a minimum value at one of the ends of the slit-shaped opening to a maximum value at the other end of the opening (30).

15 39. A cartridge according to any one of claims 23 to 32, characterised in that the filter (23, 24) includes a filter element formed by a first disc (41) and a second disc (42), which are arranged in parallel with each other and separated from each other by an interspace (44) that form the slit-shaped opening (30).

20 40. A cartridge according to claim 39, characterised in that the interspace (44) is formed by distance members (43) arranged in the interspace (44) between the discs (41, 42), each of said distance members (43) having a predetermined height corresponding to the
25 second extension (32).

41. A cartridge according to 40, characterised in that each of said distance members (43) includes a projection extending from one of the first disc (41) and the second disc (42).

30 42. A cartridge according to any one of claims 39 to 41, characterised in that the first disc (41) is provided with at least one aperture (46) forming an outlet passage to the interspace (44), and that the second disc (42) is provided with at least one aperture (47)
35 forming an inlet passage from the interspace (44).

43. A cartridge according to any one of claims 23 to 42, characterised in that the filter (23, 24) is made through an injection moulding process.

- 5 44. A cartridge arranged to contain a particulate material (20), wherein the cartridge includes:
an inner space (10) for housing the particulate material;
an inlet (21) arranged to permit the introduction of a liquid into the inner space (10);
10 an outlet (22) arranged to permit the discharge of liquid from the inner space (10); and
at least a second filter (24) arranged at the inlet (21) and to permit passage of the liquid through the filter (24), but to prevent passage of the particulate material (20) through the filter (24), wherein the
15 second filter permits the liquid to pass through the filter (24) in a filter direction (x), characterised in that the second filter includes at least one slit-shaped opening, which has a first extension (31) and a second extension (32) being substantially perpendicular to the filter direction (x) and to the first extension (31), wherein the second
20 extension (32) is significantly shorter than the first extension (31).

45. A cartridge according to claim 44, characterised in that the second extension (32) is significantly shorter than the length of the slit-shaped opening in the filter direction (x).

25

46. A cartridge according to any one of claims 44 and 45, characterised in that the second extension (32) is equal to or less than 0,12 mm.

- 30 47. A cartridge according to any one of claims 44 to 46, characterised in that the second extension (32) is equal to or less than 0,10 mm or 0,08 mm.

48. A cartridge according to any one of claims 44 to 47,
35 characterised in that the second extension (32) is equal to or more than 0,02 mm.

49. A cartridge according to any one of claims 44 to 48, characterised in that the second extension (32) is equal to or more than 0,04 mm.
- 5 50. A cartridge according to any one of claims 44 to 49, characterised in that the second extension (32) is approximately 0,06 mm.
- 10 51. A cartridge according to any one of claims 44 to 50, characterised in that the filter (23, 24) is made of a polymer material, including one of polypropylene and polycarbonate.
- 15 52. A cartridge according to any one of claims 44 to 51, characterised in that the first extension (31) is substantially perpendicular to the filter direction (x).
- 20 53. A cartridge according to any one of claims 44 to 52, characterised in that the filter (24) includes a filter element (29'), wherein the slit-shaped opening (30) extends through the filter element.
- 25 54. A cartridge according to claim 53, characterised in that the filter (23, 24) includes a plurality of slit-shaped openings (30), which extend through the filter element (29').
- 30 55. A cartridge according to claim 54, characterised in that the first extension (31) of each slit-shaped opening (30) extends in a radial direction towards a centre point of the filter element (29').
- 30 56. A cartridge according to any one of claims 53 to 55, characterised in that the filter element (29) has a conical shape.
- 35 57. A cartridge according to any one of claims 53 to 56, characterised in that the filter (24) includes a peripheral support portion connected to the filter element (29') and abutting an inner wall of the cartridge.

58. A cartridge according to claim 57, characterised in that the peripheral support portion has a peripheral surface and includes a plurality of ridges projecting from the peripheral surface and abutting the inner wall of the cartridge, wherein a thin gap is formed
5 between the peripheral surface and the inner wall, said gap providing a further passage for the liquid.

59. A cartridge according to any one of claims 54 to 59, characterised in that the slit-shaped opening (30) of the filter
10 element (29') has a first end and a second end, wherein the second extension (32) of the slit-shaped opening decreases from a maximum value at the first end of the slit-shaped opening to a minimum value at the second end of the opening (30).

15 60. A cartridge according to any one of claims 44 to 59, characterised in that the filter (23, 24) is made through an injection moulding process.

61. A use of a filter (23, 24) in a cartridge (9) containing a
20 particulate material, wherein the cartridge includes:
an inner space (10) for housing the particulate material (20);
an inlet (21) arranged to permit the introduction of a liquid into the inner space (10);
an outlet (22) arranged to permit discharge of liquid from the inner
25 space (10); and
at least one filter (23) arranged at the outlet (22) and to permit passage of the liquid through the filter, but to prevent passage of the particulate material through the filter, wherein the filter permits the liquid to pass through the filter in a filter direction (x), wherein
30 the filter (23) includes at least one slit-shaped opening (30), which has a first extension (31) and a second extension (32) substantially perpendicular to the filter direction (x) and to the first extension (31), wherein the second extension (32) is significantly shorter than the first extension (31), the use including the step of supplying said
35 liquid to the cartridge (9) in such a way that the liquid passes through the particulate material (20) and thereby dissolves at least a part of the particulate material (20) to form a liquid solution.

62. A use according to claim 61, wherein the liquid is a dialysis liquid.

5 63. A use according to any one of claims 61 and 62, wherein the particulate material includes bicarbonate and/or sodium chloride.

64. A use of according to claim 61, wherein the liquid includes a cleaning substance.

10

65. A system for preparing a liquid solution for a medical procedure, the system including:

a cartridge containing a particulate material in an inner space thereof and including an inlet (21) and an outlet (22);

15 a first liquid conduit (3) having a first end (4) communicating with a source (1) of liquid to withdraw the liquid into the first liquid conduit (3) and a second end;

20 a second liquid conduit (6) having a first end (7) communicating with a source (1) of liquid and a second end (8) communicating with the inlet of the cartridge (9) for introducing the liquid into the inner space (10) to produce a concentrate liquid solution containing at least a part of the particulate material dissolved in the liquid;

25 a third liquid conduit (11) communicating with the outlet of the cartridge and with a mixing point (13) in the first liquid conduit (3) intermediate said first and second ends (4, 5) for conducting said concentrate liquid solution from the cartridge (9) into said first liquid conduit to be mixed with the liquid being conducted through the first liquid conduit to thereby produce said liquid solution in the first liquid conduit for delivery to said second end of the first liquid conduit; and

30 at least one filter (23) arranged at the outlet (22) and to permit passage of the liquid through the filter, but to prevent passage of the particulate material through the filter, wherein the filter (23) permits the liquid to pass through the filter in a filter direction (x),
35 characterised in that the filter includes at least one slit-shaped opening (30), which has a first extension (31) and a second extension (32) being substantially perpendicular to the filter

direction (x) and to the first extension (31), wherein the second extension (32) is significantly shorter than the first extension (31).

5 66. A system according to claim 65, wherein the cartridge includes a second filter (24) arranged at the inlet (21) and to permit passage of the liquid through the filter (24), but to prevent passage of the particulate material (20) through the filter (24), wherein the second filter permits the liquid to pass through the filter (24) in a filter direction (x), characterised in that the second filter includes at
10 least one slit-shaped opening, which has a first extension (31) and a second extension (32) being substantially perpendicular to the filter direction (x) and to the first extension (31), wherein the second extension (32) is significantly shorter than the first extension (31).

15 67. A system according to any one of claims 65 and 66, characterised in that the filter includes the features of any one of claims 2 to 22.

20 68. A system according to any one of claims 65 to 67, wherein the liquid is a dialysis liquid.

69. A system according to any one of claims 65 to 68, wherein the particulate material includes bicarbonate and/or sodium chloride.